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ABSTRACT

This study attempted to determine if the achievement of fourth grade students with high or low dominance characteristics would be affected by differing social reinforcers during a study of multiplication facts using a CAI system. The experimenter identified the high and low dominant students by means of a group personality test developed by Porter and Cattell. The students in each category were then randomly assigned to two treatment groups. One group received both praise and reprimand from the computer while the other group received reprimand only. The results of the experiment indicated that the use of reinforcement patterns of praise and reprimand alone did not affect achievement in a relatively short-range CAI study with high and low dominant fourth grade students. The experimenter suggests that prior to the use of CAI for instructional purposes, long-range studies of social-reinforcer-personality-trait relationships should be implemented. [Not available in hardcopy due to marginal legibility of original document.] (Author/FL)

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A STUDY OF THE USE OF CERTAIN SOCIAL REINFORCERS IN COMPUTER-ASSISTED INSTRUCTION

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Classroom teachers, in reacting to student responses, frequently use more words than"right" or "wrong". These teacher responses are often augmented by words of praise, such as "Good work", or of reproof such as "Don't get careless now." These words of praise and reprimand (reproof) are sometimes called social reinforcers. Apparently the choice of appropriate reinforcers is based upon many variables besides the accuracy of student responses. It is very possible that two students who give correct responses to questions of relatively equal difficulty will receive dramatically different social reinforcers. One might be given lavish praise, while the other would not. Teachers often defend such differentiation of the basis of student personality. One hears such teacher statements as "Johnny needs confidence and I give him all the encouragement I can" or "Mary is self-sufficient; I need not do anything extra in order to motivate her." Since the best models to follow in developing programs for computer-assisted instruction (CAI) are probably the behavior patterns of "live" teachers and since, teachers deem social reinforcers to be important, it seems reasonable to assert that a workable strategy for the selection and presentation of social reinforcers is

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needed for CAI, and it would seem that the presentation of reinforcers should not only be related to the accuracy of responses but to the personality of the learner as well.

Stolurow (1) suggests that CAI systems use the student's ability, personality, and knowledge in making decisions while the student is learning. Past research (which may not be directly applicable to the CAI situation) offers few guidelines because, as recent survey shows, only a few studies took personality into consideration (2). Frase (3), however, found that reproof alone was more effective than praise for aggressive college students studying logic materials from programmed textbooks. His research also led him to conclude that "....social reinforcement phenomena (with printed stimulus materials) observed in a programmed learning task demonstrated the same characteristics as reinforcement phenomena observed under direct verbal interaction of E and S." (4)

This study sought to determine if the achievement of fourth grade students at the Indiana State University Laboratory School with high or low dominance characteristics would be effected by differing social reinforcers during their study of the multiplication facts through a CAI system. (5) The authors of the group personality test used in this study (6) use the terms assertive, independent, aggressive, and stubborn to describe high dominant children identified by the test and obedient, mild, conforming and

submissive for the low dominant. Thus the former would tend to be similar to the aggressive students studied by Frase. Because of the evidence to suggest that the aggressive would do better with reprimanding reinforcers alone and the belief that the low dominant might be inhibited by reprimands alone and tend to respond better to total guidance, the reinforcement patterns of reprimands alone (for incorrect answers); and praise (for correct responses) and reprimand (for incorrect) were used.

The Students

The ISU Laboratory school serves an urban attendance district in Terre Haute, Indiana, for the Vigo County School Corporation. The students chosen for this study were from the two fourth grade rooms and ranged in age from 9 to 11 years. Sixty-five percent of the students were 9 years old at the inception of the study and one student was 11 years old. Nine were boys and 11 were girls. Their Lorge-Thorndike non-verbal IQ scores ranged from 74 to 128 with a mean of 102. In their classrooms, the students were divided into equal groups according to mathematical ability, one of the teachers taught all of high ability students, the other taught the remainder. The teachers used the same textbooks and remarkably similar methods of teaching.

The CAI System

The computer-teacher in this study was an IBM Model 1130 which was programmed to present the multiplication

facts, one at a time, via its console-typewriter, judge the student response which was also typed in, write a reinforcing statement and give the correct answer if necessary. A more detailed description is given in an earlier article. (7)

The phrases used as social reinforcers were:

GOOD

FINE

YOU ARE DOING VERY WELL

RIGHT

VERY GOOD (Student's name)

NICE WORK (Student's name)

GOOD WORK

CORRECT KEEP IT UP

YOU ARE DOING VERY WELL

KEEP UP THE GOOD WORK

NO. XX IS THE RIGHT ANSWER

ERROR, XX IS THE RIGHT ANSWER

THINK, XX IS THE RIGHT ANSWER

THAT IS NOT VERY GOOD, XX IS THE RIGHT ANSWER

THAT IS NOT THE RIGHT ANSWER, XX IS THE RIGHT ANSWER

WRONG, XX IS THE RIGHT ANSWER

WRONG, XX IS THE RIGHT ANSWER TRY AGAIN

If, during the course of the teaching session, a student answered an item correctly five consecutive times, the item would be retired and the following message typed:

CONGRATULATIONS, THIS PROBLEM WILL NOT BE ASKED AGAIN TODAY. On the other hand, if a student answered an item incorrectly three times, the item would again be retired and this message presented after a statement of reproof from the above list: YOU NEED HELP WITH THIS ITEM? PROBLEM, I WILL NOT ASK IT AGAIN TODAY. These statements indicating item retirement were another source of social reinforcement.

The multiplication facts were presented randomly within categories of difficulty. The student would then type in an answer. If it was correct the computer would, at the option of the experimenter, randomly select and print one of the phrases of praise from the list above. If the answer was not correct a reprimand could be typed along with the correct answer. The reinforcement options available were praise, reprimand, both, or neither.

Procedure (8)

A timed test over the 100 multiplication facts was administered to the fourth graders described previously. Students with scores which indicated a non-mastery of the facts as the five second recall level were given the group personality test previously mentioned. The tests were hand scored and the national norms given in the test manual were used to identify the high (70th decile and above) and low (40th decile and below) dominant. children.

The twenty students selected were again tested over the multiplication facts (the pre-test) and were then each

given four 20 minute sessions with the CAI system. The sessions were about a week apart. They were tested again a week after the termination of the sessions (post test) and 11 weeks later (retention test). The tests were machine scored and the responses analyzed by the ISU Research and Testing Center which reported Kuder-Richarson Formula 20 reliability coefficients of .89,.95 and .97 respectively.

The students in each category of high-low dominance were randomly assigned to two treatment groups. One group received both praise and reprimand from the computer-teacher while the other received reprimand only. The means of the test scores for the students assigned to each cell are given by Table 1.

MEANS OF ACHIEVEMENT TEST RESULTS

Dominance	Reinforcement					
	Praise and Reproof			Reproof alone		
	pre	post	ret'n	pre	post	ret'n
High	44.8	73.0	77.4	59.4	86.6	82.4
Low	47.2	70.0	68.6	42.0	67.3	64.0

Table 1

An analysis of variance design assuming a fixed model for three factors (dominance, reinforcement, achievement) with repeated measures on the third factor (achievement) was utilized. The results were analyzed according to a computational procedure described by Winer (9). Since the scores of two students were not available for the retention test, all their scores were deleted from the data and an

unweighted means computation utilizing the harmonic mean was used in order to compensate for the unequal cell frequencies. The results are summarized in Table 2.

ANALYSIS OF VARIANCE SUMMARY TABLE

Source of Variation	Sum of Squares	df	MS	F
Between subjects	11,289	17		
Dominance	1,488	1	1488	2.35
Reinforcement	151	1	151	.238
Interaction	753	1	753	1.19
Subjects with groups	8,880	14	634	
Within Subjects	9,944	36		
Trials (Achievement)	7,357	2	3679	*54.19
Dominance x Achievement	86	2	43	.63
Reinforcement x Achievement	73.1	2	36.6	.54
Dominance x Reinforcement x Achievement	51.6	2	25.8	.38
Achievement x Subjects with groups	1,901	28	67.9	

$F(1, 14; .05) = 4.6$

$*F(1, 28; .01) = 7.64$ (Conservative test)

Table 2

The procedures lead to the conclusions that at the .05 level of confidence, there is no statistical reason to reject the hypotheses that:

1. High-low dominant personality traits were not related to achievement in this situation.
2. The type of social reinforcement employed (praise and reprimand vs. reprimand alone) does not effect achievement.
3. There are no interaction effects. That is, no particular combinations of personality and reinforcement lead to greater achievement.

The analysis did show, however, that there are differences between the measures of achievement. A further analysis using the Scheffe Test (11) for differences between pairs of means lead to the conclusions, at the .01 confidence level, that the post-test scores are different from the pre-test and that the post-test scores did not differ from the retention test scores.

CONCLUSIONS AND RECOMMENDATIONS

This research did not involve all or even most of the questions relative to personality-social reinforcement issues. The interactions of other personality traits and reinforcement patterns should be studied if the potential of CAI as an instrument for individualizing instruction is to be realized.

The ever increasing body of knowledge relative to the efficacy of CAI systems was supplemented by this study in that all groups of students learned and retained the knowledge taught after only four sessions of twenty minutes each.

The use of the various social reinforcers, however, did not effect achievement and there were no interaction effects. It would seem then that these specific factors need not be considered as variables in future, similar CAI research. A word of caution should be raised, however. Although it was not reflected in the achievement test scores, the comments of some of the students receiving reproof alone indicated that some negative attitudes were developing. A study of greater duration might have produced different results. Since it is possible that overall pupil enthusiasm towards the CAI system and the individual attention it afforded the learners overshadowed potentially inhibiting aspects of the treatment, it is certainly plausible that in a school or long term research situation where CAI is no

longer a novelty, the development of negative attitudes would eventually diminish achievement for some students.

A conjecture for futher research also arises from a study of Table 1. The only pupils who had higher retention than post test scores were the high dominant who received both types of reinforcement. An examination of the individual scores in the high-dominant-praise and reprimand group revealed that one student had identical post-retention scores and all of the others gained. This might indicate that the type of reinforcement had a favorable effect on the attitudes of these particular children and that they were thus motivated to keep on learning even after the CAI experience. If this conjecture is correct, it would contradict the results of Frase who found that reprimanding reinforcers formed more favorable attitudes in aggressive students.

In summary, the results of this study led to the conclusion that the use of reinforcement patterns of praise and reprimand or reprimand alone did not effect achievement in a relatively short range (one session per week for four weeks) CAI study with high and low dominant fourth graders. There are some indications, however, thatresults might be different if a similar study were conducted over a longer period of time. It would seem that prior to the use of CAI for instructional purposes, long range studies of social-reinforcer-personality trait relationships should be implemented.

FOOTNOTES

1. Lawrence M. Stolurow, "Idiographic Programming," National Society for Programmed Instruction Journal, IV (Oct. 1965), p. 12.

2. Steven P. Dingfelder, "An Investigation of the Effects of Praise and Reproof Upon Preserverance at Tasks of Differing Levels of Complexity Employing Ss of Two Age Levels," unpublished MA thesis, Indiana State University, 1968, p. 16.

3. Lawrence T. Frase, "The Effects of Social Reinforcers in A Programmed Learning Tast," MS Thesis, University Of Illinois, 1963, p. 30. (The same title is also listed as Technical Reproduction No. 11, Training Research Laboratory, the University of Illinois, Urbana, Illinois.

4. ibid. p. 26.

5. Funds and computer resources for the study were furnished by Indiana State University.

6. Rutherford B. Porter and Raymond B. Cattell, IPAT CHILDREN'S PERSONALITY QUESTIONNAIRE "THE CPQ", Institute for Personality and Ability Testing, Champaign, Illinois 1959.

7. James L. Fejfar, "A teaching Program for Experimentation with Computer Assisted Instruction," THE ARITHMETIC TEACHER, March, 1969, p. 184-187.

8. The Author wishes to thank professors Gerald Hershony of the ISU Mathematics Department and Jerry Jankins of the School of Education for assistance in the statistical aspects of this research.

9. B. J. Winer, Statistical Principles in Experimental Design (New York, McGraw-Hill, 1962, p. 342-345 and 357-377.

10. To avoid proving that the homogeniety assumptions usually associated with this analysis were not violated, the conservative test described by Winer, p. 305 was used.

11. H. Scheffe, The Analysis of Variance (New York, John P. Wiley, 1959), p. 66-72.